

## Taxonomic review of the *Pieris dubernardi*-group, with description of a new subspecies from Northern Sichuan, China (Lepidoptera, Pieridae)

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**Abstract** Morphological characteristics of the butterflies belonging to the *Pieris dubernardi*-group are examined based on the original descriptions, photographs of the type specimens, and newly obtained butterfly specimens. As a result of the examinations and subsequent discussions, taxonomic statuses of the butterflies are confirmed, and a new subspecies of *Pieris dubernardi* Oberthür, 1884 from Northern Sichuan is described and illustrated. A distribution map of the group is also given.

**Key words** *Pieris chumbiensis*, *Pieris dubernardi*, *Pieris dubernardi lixianensis* ssp. nov., *Pieris gyantsensis*, *Sinopieris wangi*, *Synchloe kozlovi*, systematics, taxonomy, the Himalayas, Tibet.

### Introduction

The *Pieris dubernardi*-group includes ten taxa, *dubernardi*, *chumbiensis*, *kozlovi*, *gyantsensis*, *rothschildi*, *bromkampii*, *shelpae*, *aljinensis*, *wangi* and *pomiensis*, inhabiting in the hinterland of the Himalayas or Tibetan mountains at 3,000 - 5,000 m altitude (Ziegler, 2016). They have been variously classified as belonging to the genera *Pieris*, *Aporia* (Leech, 1892 - 1894), *Parapieris* (De Nicéville, 1897), *Synchloe* (Röber, 1906), *Pontia* (Epstein, 1979) and *Sinipieris* (Huang, 1995) for 130 years after *Pieris dubernardi* Oberthür, 1884 was initially described, due to their rarity, the historical transition of genera, and the lack of information on their life histories. Recently, Tadokoro & Wang (2014) placed them in the genus *Pieris*, but the status of the taxa remained uncertain due to lack of information. Now, we have had opportunities to examine some specimens of the *Pieris dubernardi*-group, and try to review their taxonomic statuses.

### Material and methods

Morphological characteristics of the *Pieris dubernardi*-group are examined based on photographs of the type specimens, original descriptions and some newly obtained specimens. Photographs of the type specimens of *Pieris dubernardi*, *kozlovi*, *gyantsensis* and *bromkampii* were provided by NHM in London, and figures or photographs of *P. dubernardi*, *chumbiensis*, *kozlovi*, *aljinensis*, *wangi* and *pomiensis* from their original descriptions or Verity (1905-1911) were used for this study. The specimen of *P. dubernardi* (D1) was collected in Zhongdian district in Northwest Yunnan (alt. 3,100m), and the specimens of its Northern Sichuan

population (D2) are from Miyaluo (alt. 3,700 m) in Li-Xian, *kozlovi* specimens (D3) are from Chanpi-Shankou (alt. 3,800 - 4,000m) near Qinghai lake in Qinghai, *pomiensis* specimens (D4) are from Demula-shan pass nearby Pomi in Tibet (alt. 4,700m), *gyantsensis* specimens (C1) are from Gyantse nearby Lhasa in Tibet (alt. 4,000m), and *sherpae* specimens (C2) are from Central Nepal (alt. 3,700m). Specimens D1-D4 resembled *P. dubernardi*, (treated as subgroup-D) and C1-C2 resembled *P. chumbiensis* in wing markings (treated as subgroup-C).

Androconia were removed from the upper side of the male forewings, and were observed by optical microscope at 400 magnifications. Male genitalia were dissected and were observed by stereomicroscope at 20 magnifications after removing membranes and muscles with 20% KOH solution.

### Results and discussion

#### Historical review and identification of the specimens

Prior to the examination of the specimens, we summarize the original descriptions of every taxon, and identify newly obtained specimens.

① *Pieris dubernardi* Oberthür, 1884. Type locality is Tsékou (Yanmen) in N. W. Yunnan, China. The type specimen (Fig. 1) is the only male deposited

in NHM, London. A large specimen D 1 (Fig. 2 -D1) from Zhongdian district in Northwest Yunnan (alt. 3,100 m) is identified as the nominotypical subspecies of *P. dubernardi*.

② Leech (1892 - 1894) classified *P. dubernardi* under the genus *Aporia*, and introduced a female specimen of this species

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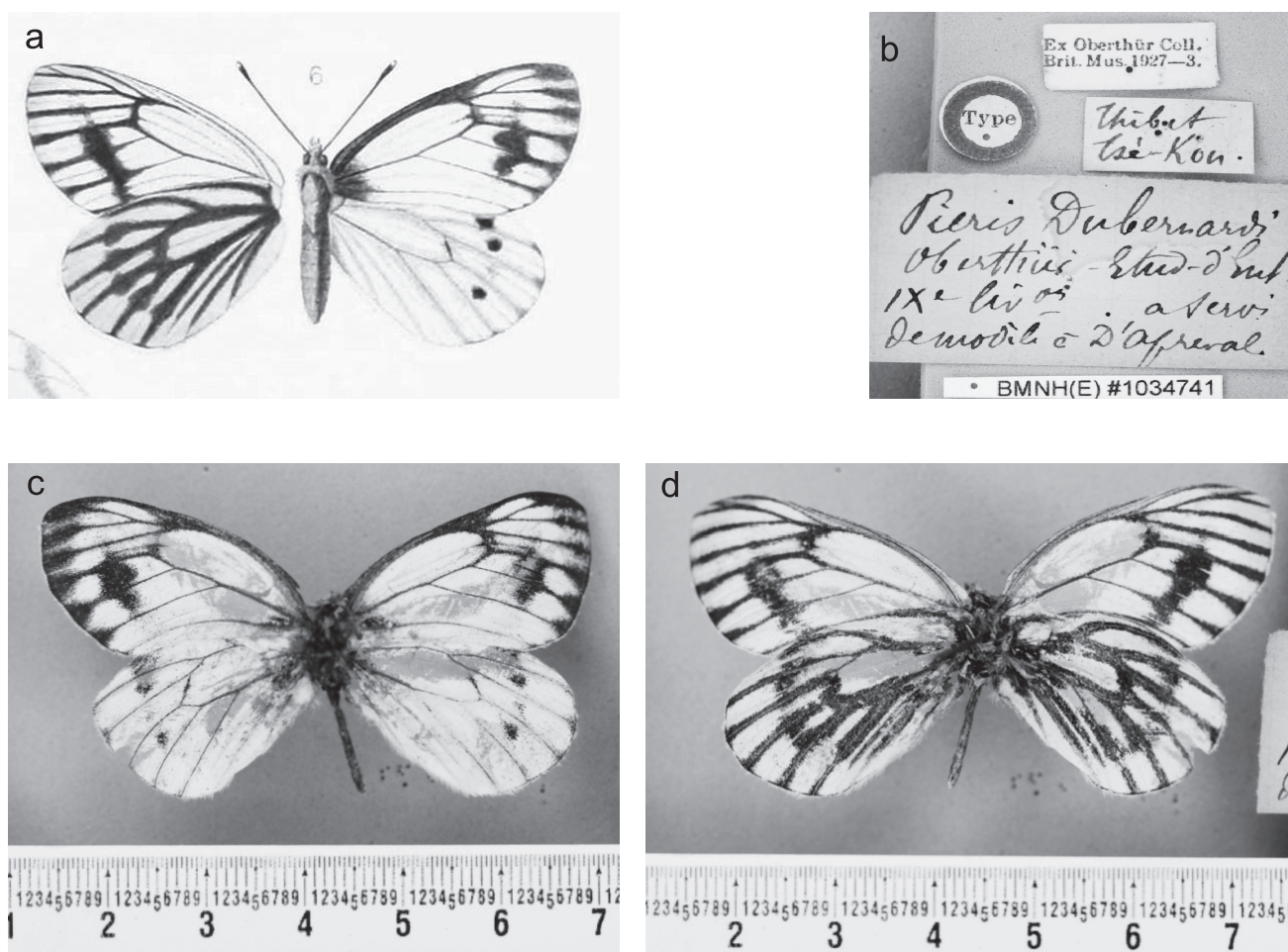


Fig.1. *Pieris dubernardi* ♂ [a: after Oberthür (1884), b-d: Type specimens © NHM].

(Fig. 3) from Sichuan. Its distribution area was thereafter extended toward the southern part of Sichuan, including Ta-chien-lu (Kangding), Ni-tou, Wa-ssu-kou and Chow-pin-sa. However, the northern Sichuan population D 2 (Fig. 2 -D2) is small in wing expanses and variable in wing markings, while the Yunnan population D 1 (Fig. 2 -D1) is constant in both wing markings and wing expanses.

③ *Parapieris chumbiensis* de Nicéville, 1897. Type locality is Chumbi Valley in Sikkim, India. De Nicéville (1897) described a new genus *Parapieris* defined by the type species of *Papilio callidice* Hübner, [1800], and included both *P. dubernardi* and *P. chumbiensis* into the genus *Parapieris*. All of the type specimens of *chumbiensis* are males, and deposited in the Indian museum in Calcutta. As we have been unable to find the type specimen in the museum so far, only the figure in de Nicéville (1897) (Fig. 4) is used to illustrate its wing markings.

④ *Pieris dubernardi* var. *kozlovi* Alphéraky, 1897 (Fig. 5 up). Type locality is Nan-shan (Humbolt chain), east of Qaidam Pendi in Qinghai, China. A male co-type specimen (Fig. 5 dn) was found in NHM. The specimen D 3 (Fig. 6) from Chapi-

Sankou near Qinghai Lake resembles the co-type specimen, and is identified as *kozlovi*.

⑤ Röber (1906) included the *P. dubernardi*-group in the genus *Synchlœ* Hübner, 1818, of which the genus *Parapieris* had been sunk into a synonym. Röber (1906) illustrated a *S. chumbiensis* ♂ in place of *S. dubernardi* ♂, and a *S. dubernardi* ♂ in place of ♀ in his plate (Fig. 7). His misidentification or misprint may have contributed to later taxonomic confusion about the *Pieris dubernardi*-group

⑥ *Pieris dubernardi chumbiensis* race *gyantsensis* Verity, 1911 was described from Gyantse in Tibet near Lhasa. Type specimens (Fig. 8) were deposited in NHM in London. The specimens C 1 (Fig. 9) from Gyantse are identified as *gyantsensis*. Later, Talbot (1932) treated the name *gyantsensis* as a varid subspecies of *Synchlœ dubernardi*.

⑦ *Pieris dubernardi* var. *rothschildi* Verity, 1911 (Fig. 10) was described from Tai-pai-chan (太白山) in the Tsing-ling Mountains, Shaanxi, China. Type specimens should be kept in NHM (Rothschild collection), but according to NHM are missing.



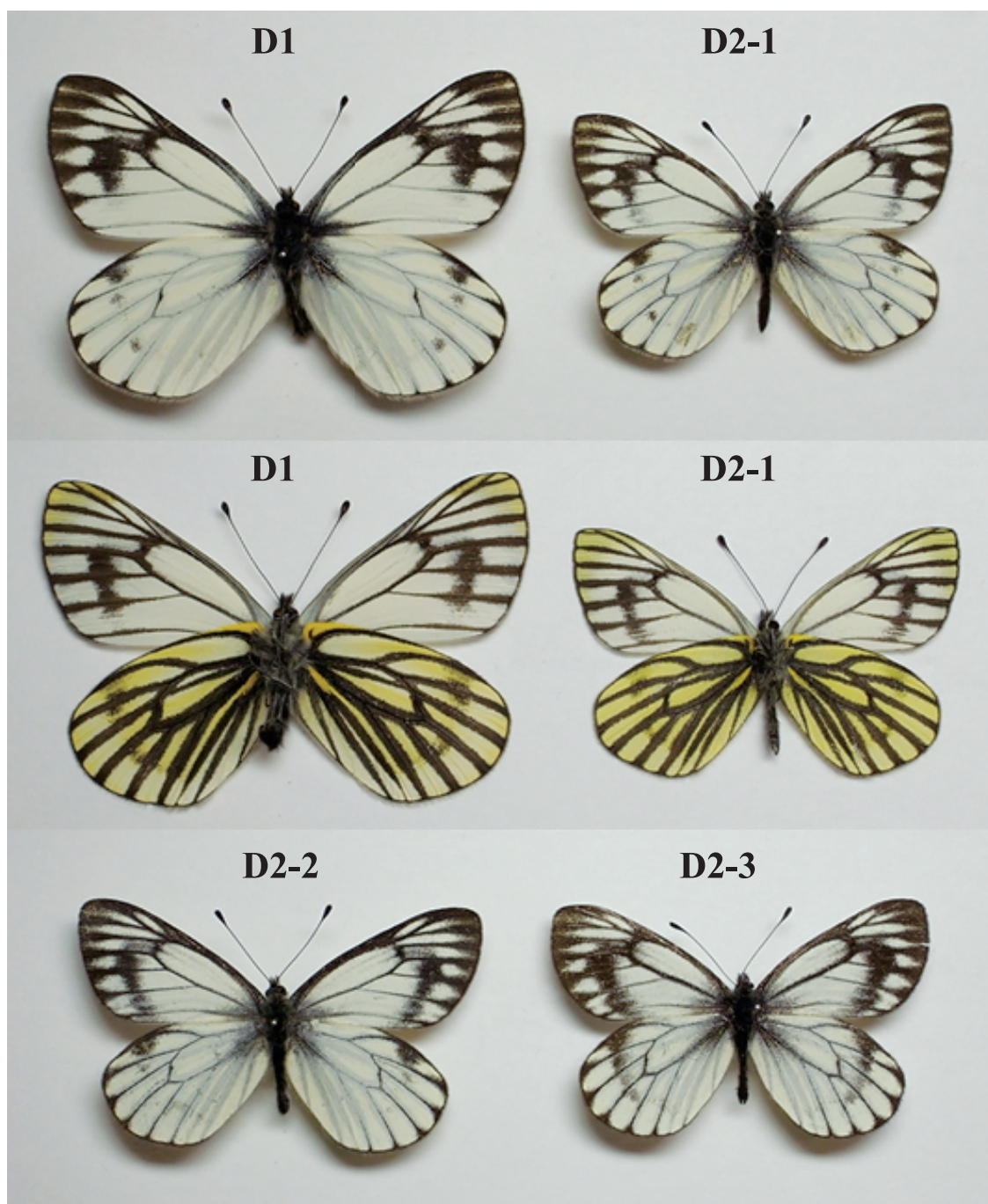


Fig. 2. *Pieris dubernardi* ♂ from Yunnan and N. Sichuan.

D1: from N. W. Yunnan, D2-1: from N. Sichuan, D2- 2 and D2-3: from N. Sichuan (alt. 3,700m)

(Variations of post-discal band D2-1, D2-2 and D2-3) = ssp. *lixianensis*

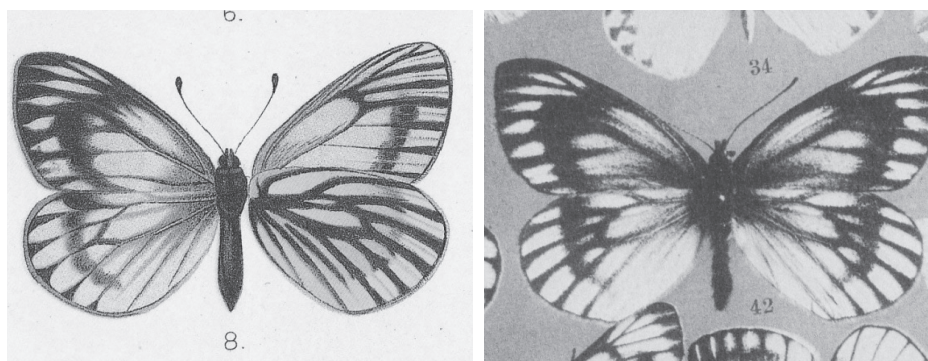


Fig. 3. *Aporia dubernardi* ♀ from Sichuan [left: after Leech (1892-1894), right: Verity (1905-1911)].

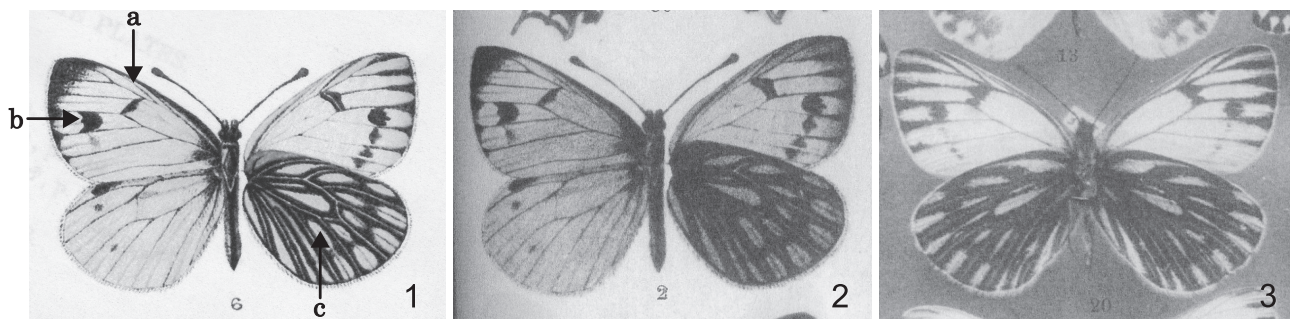


Fig. 4. *Parapieris chumbiensis* ♂ [1: after de Nicéville (1897), 2 and 3: Verity (1905-1911)].

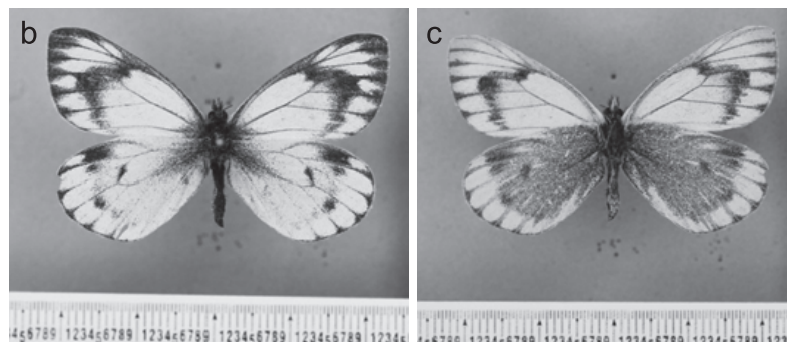


Fig. 5. *Pieris d. kozlovi*. a: after Alphéraky (1897), b-c: Co-type specimen ©NHM.



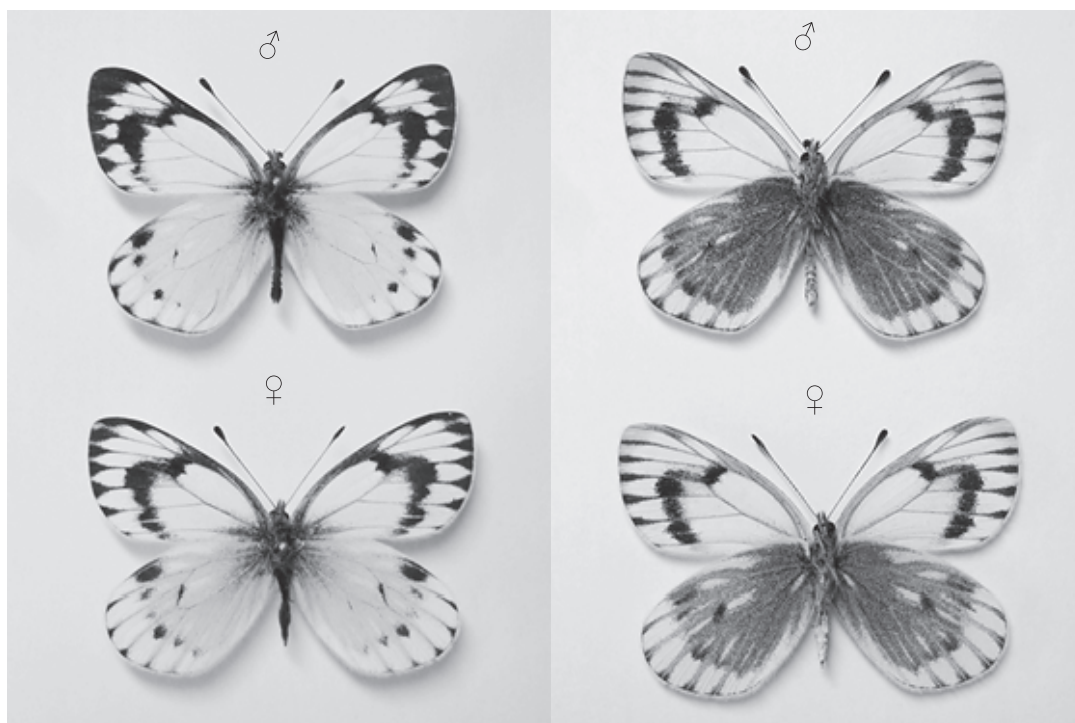


Fig. 6. *Pieris kozlovi* from Qinghai Lake, Qinghai (D3).

⑧ *Synchlœ dubernardi bromkampii* Bang-Haas, 1938 was described from Min-shan in Gansu Province, China (alt. 3,500 m). A syntype male specimen (Fig. 11) was found in NHM.

⑨ *Pontia sherpae* Epstein, 1979 (Fig. 12) was described from Central Nepal (alt. 3,800 - 4,900 m).

Epstein (1979) described *sherpae* as a new species, but might have not compared its wing markings with *chumbiensis* or

*gyantsensis*. The specimens C2 (Fig. 13) from Central Nepal are identified as *sherpae*.

⑩ *Synchlœ kozlovi aljinensis* Huang & Murayama, 1992 (Fig. 14) was described from Xashidaban, Aljin, Xinjiang, China (alt. 3,600-3,800 m).

⑪ *Sinopieris wangi* Huang, 1998 (Fig. 15) was described from Duoxiongla, Metok, China. Huang (1995) erected a new genus *Sinopieris* defined based on his newly described *S. gongaensis* as the type species, and included the *P. dubernardi*-group in the genus *Sinopieris*. Later, *S. gongaensis* was confirmed as a synonym of *Pieris venata* Leech, 1891 by Huang (2003). Type specimens were deposited in Qingdao Education College, China.

⑫ *Pieris dubernardi pomiensis* Yoshino, 1998 (Fig. 16) was described on the basis of one male specimen from Pomi country, Central Tibet. The specimens D 4 (Fig. 17) from Central Tibet near Pomi, including female specimen, are identified as *pomiensis*.

⑬ Tadokoro *et al.* (2014) indicated that the *P. dubernardi*-group was included in the genus *Pieris* judging from both phylogenetic analyses on the basis of the mtDNA gene and morphological examination of the androconia and male genitalia.

To date, as described above, ten available taxa have been described in the *Pieris dubernardi*-group. Type localities of those taxa and the locations of the specimens used in this study

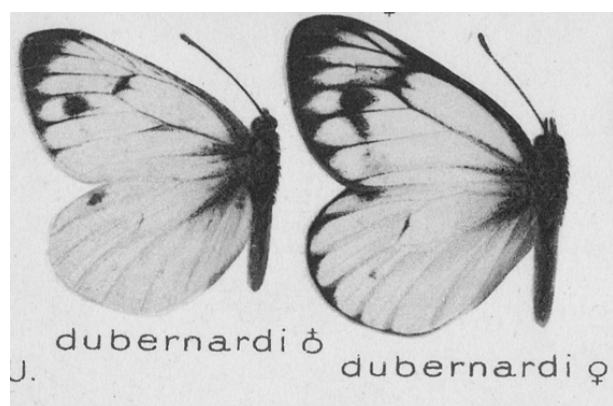


Fig. 7. *Pieris dubernardi* (after Röber, 1906).

Misidentified / Misprinted

Correction: Left = *chumbiensis* ♂, Right = *dubernardi* ♂.

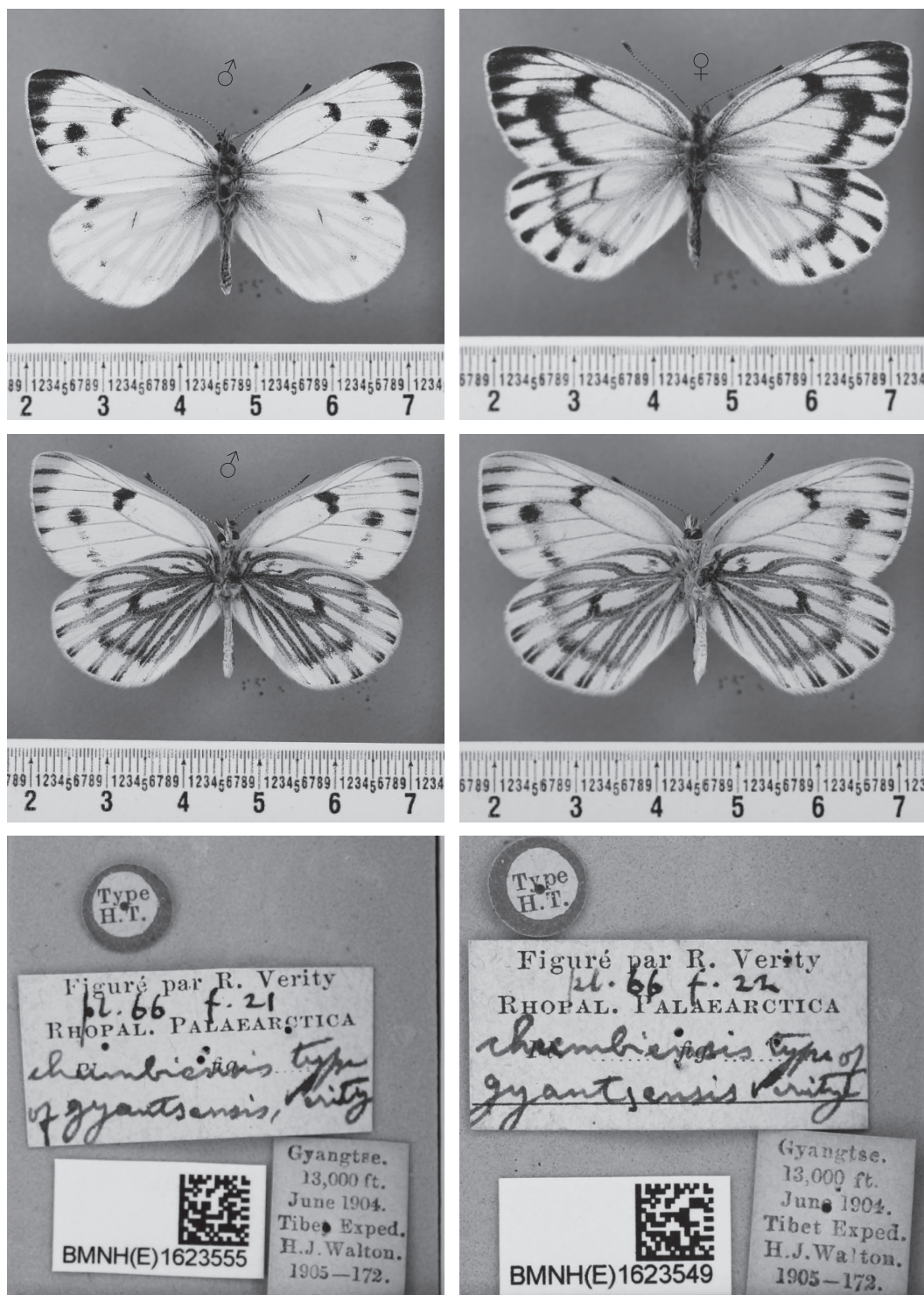


Fig. 8. *Pieris gyantsensis* [Type specimens (© NHM)].



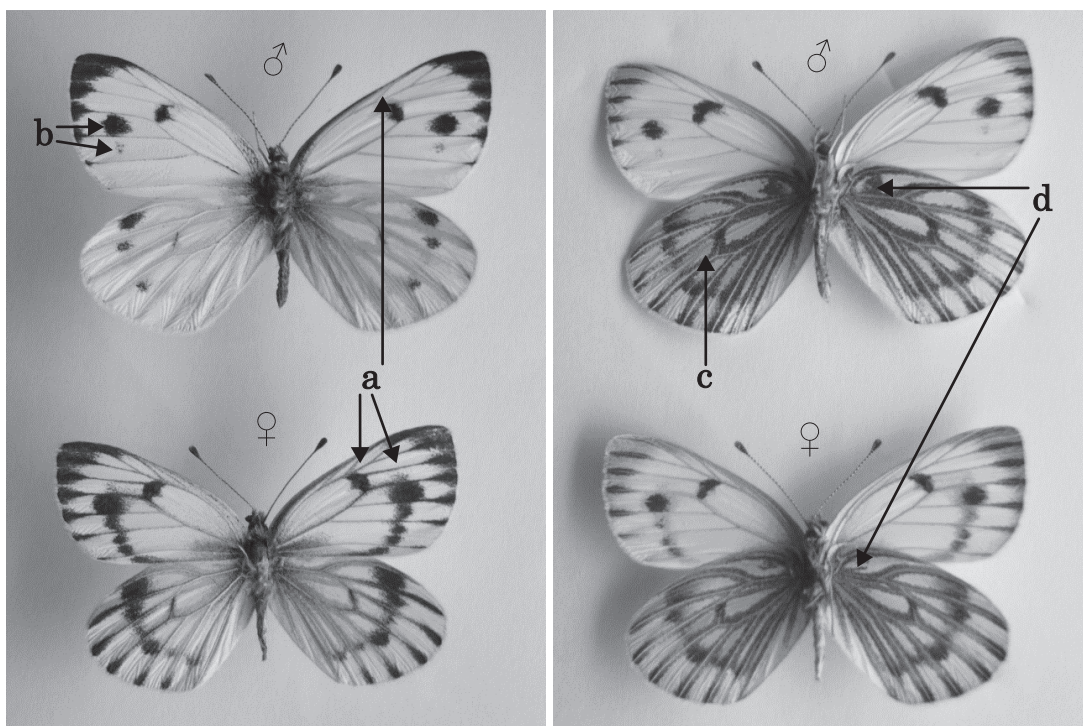


Fig. 9. *Pieris gyantsensis* from Gyantse, S. Tibet (C1).

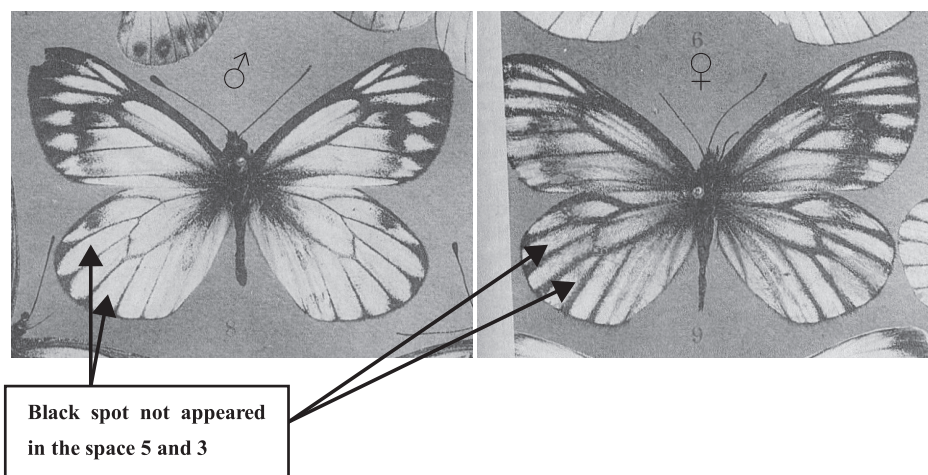


Fig. 10. *Pieris rothschildi* (after Verity, 1905-1911).

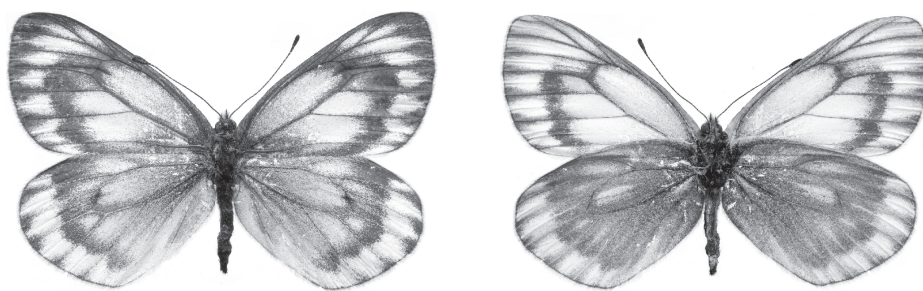


Fig. 11. *Pieris d. bromkampii* ♂ (Cotype specimen © NHM).

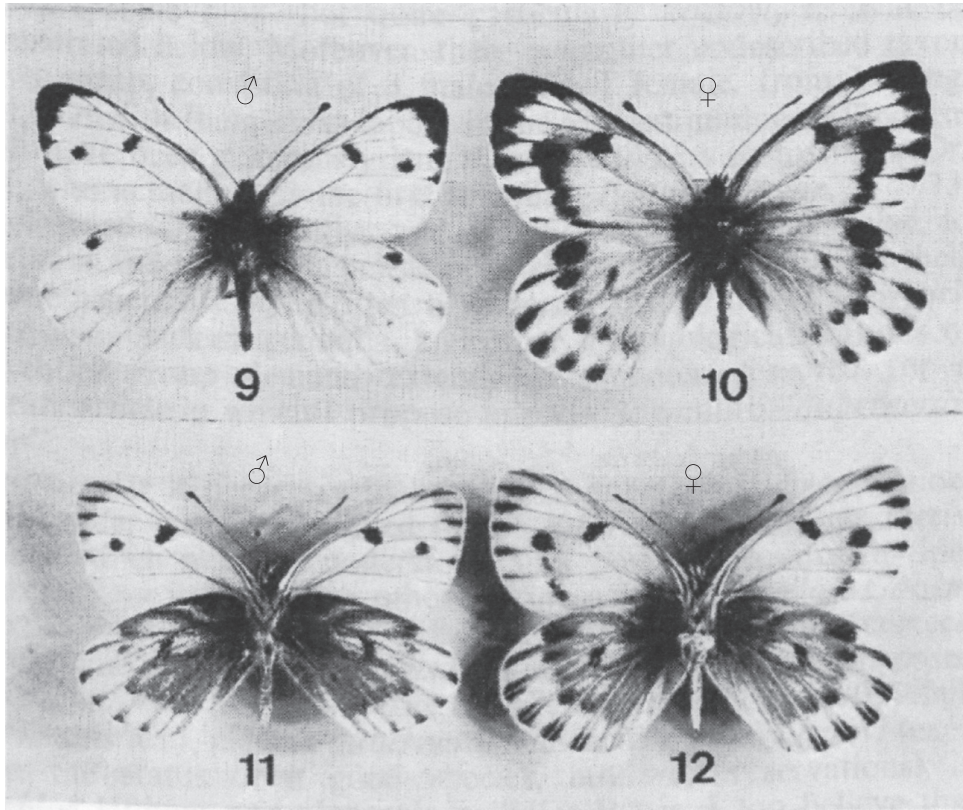


Fig. 12. *Pieris sherpae* Type specimens (after Epstein, 1979).

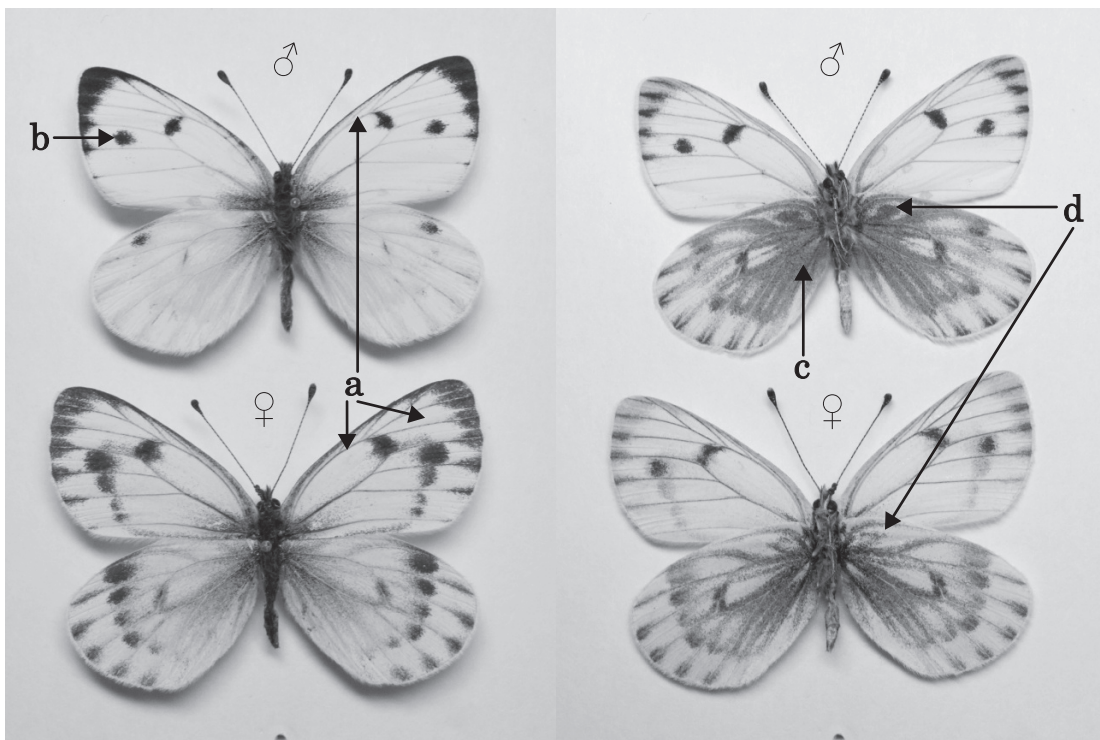


Fig. 13. *Pieris sherpae* from Central Nepal (C2).



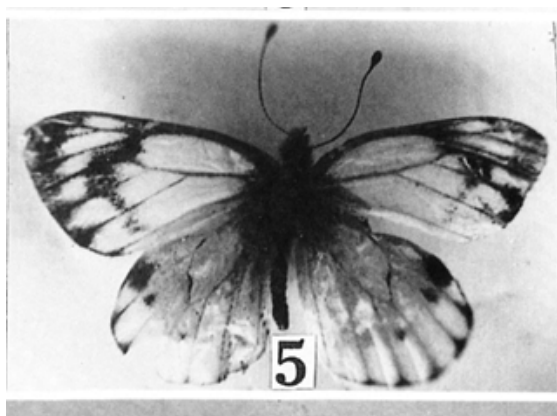


Fig. 14. *Pieris k. aljininsis* ♂ (after Huang & Murayama, 1992).

are shown in figure 18.

#### Wing markings and wing expanses:

##### *P. chumbiensis*-subgroup:

Firstly, three taxa, *P. chumbiensis* (Fig. 4), *P. gyantsensis* (Figs 8 & 9) and *P. sherpae* (Figs 12 & 13), resemble each other, and are distinct from the rest in wing markings. They are found within a limited area in the center of the Himalayas. Distinct common characteristics of those three taxa are as follows:

- ① Forewing upperside space 10-12 in males, and space 5-12 in females not dusted by black scales. → Figs 4a, 9a & 13a.
- ② Black marking in space 3 on forewing upper side independent and discontinuous to the adjacent space 2 or 4 in males. → Figs 4b, 9b & 13b.
- ③ Wing expanses small to medium. 2.2 inches [55 mm] in *P. chumbiensis* according to de Nicéville (1897), 45-52 mm in *P. gyantsensis*, and 45-53 mm (Length of forewing (LF): 24.4-26.8mm according to Epstein (1979)) in *P. sherpae*.

Differences among those three taxa are as follows:

- ④ Black marking in space 3 varies. The largest with semi-ellipse form in *P. chumbiensis*, followed by *P. gyantsensis*, and the smallest with round form in *P. sherpae*. Furthermore, *P. gyantsensis* has a small faint black marking in space 2. → Figs 4b, 9b & 13b.
- ⑤ Veins in hindwing underside basal-discal area thickly suffused by black scales in *P. sherpae* and *P. chumbiensis*, while in *P. gyantsensis* not as thick as others. → Figs 4c, 9c & 13c.

- ⑥ Basal part of space 7 on hindwing underside dusted by black scales in *P. sherpae* and *P. gyantsensis*. → Figs 9d & 13d.

##### *P. wangi*-subgroup:

Secondly, *P. wangi* (Fig. 15) is distinct in wing markings and

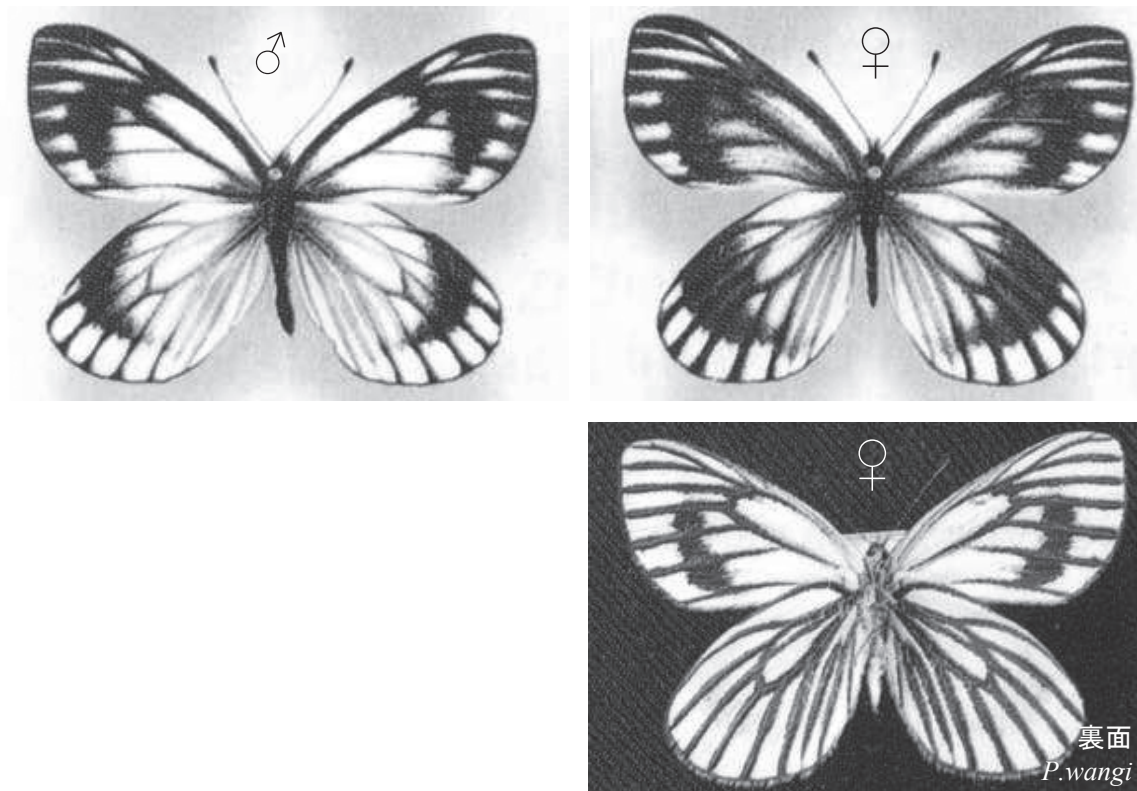


Fig. 15. *Pieris wangi* (after Ziegler, 2016; Huang, 1998).

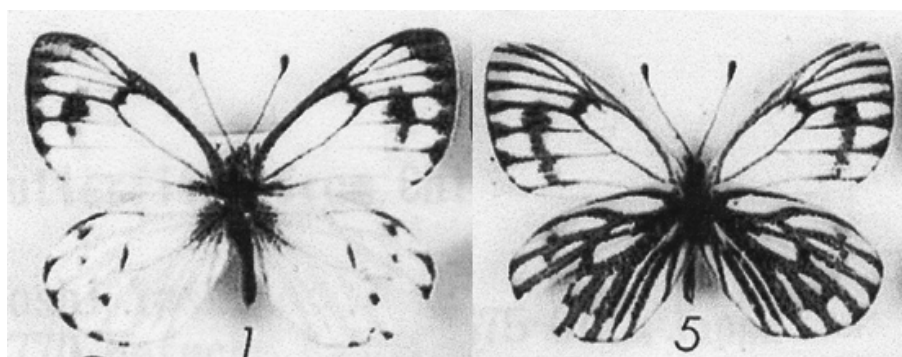


Fig. 16. *Pieris pomiensis* ♂ (after Yoshino, 1998).

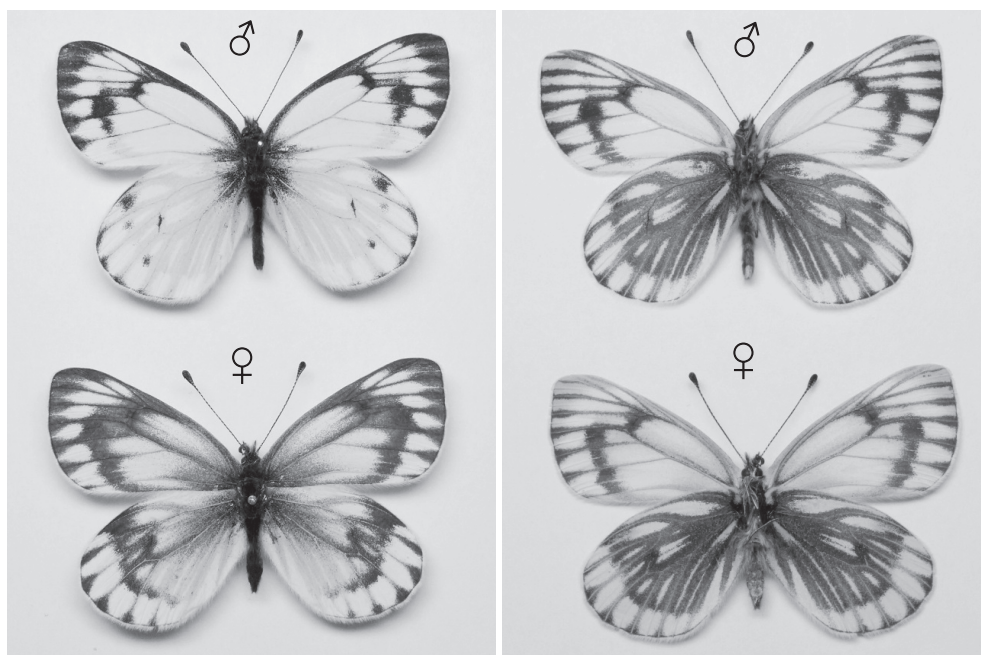


Fig. 17. *Pieris pomiensis* from central Tibet nearby Pomi (alt. 4,700m) (D4).

wing expanse. Distinct characteristics are as follows:

① Post-discal black band prominent on both forewing and hindwing upperside, but very faint or even absent on hindwing underside. Comparing to *bromkampii* (Fig. 11), similar on upperside but very different on underside.

② Wing expanse is as large as 58mm. LF is 31.5-33mm as per Huang (1998).

*P. dubernardi*-subgroup:

The remaining taxa are all similar in wing markings, but can be divided into two groups by the ground color of the basal-discal area on the hindwing underside. One is plain yellow as in *dubernardi*, *rothschildi* and *pomiensis*, the other is thickly dusted with black scales as in *kozlovi*, *bromkampii* or *aijinensis*. The former group is distributed in the southwestern part of China

including Southeast Tibet and Qinlingshan, while the latter group is distributed in the northwestern part of China including the Qilianshan or Kunlunshan mountains (Fig. 18). Each group varies mainly in two characteristics, wing expanse and post-discal band on the forewing as follows:

Former group,

① *dubernardi* (Figs 1, 2 & 3) – Nominotypical subspecies from N. W. Yunnan (D1) is the largest among the group in wing expanse, as large as 58-62mm (n=3) in male and 75mm (n=1) in the female. Wing markings are very constant.

② Northern Sichuan population (D2) is small in wing expanse, at only 48-50 mm (n= 3) in male, and variable in its wing markings mainly in the post-discal band (Fig. 2). One of them resembles the nominotypical subspecies (D1), while



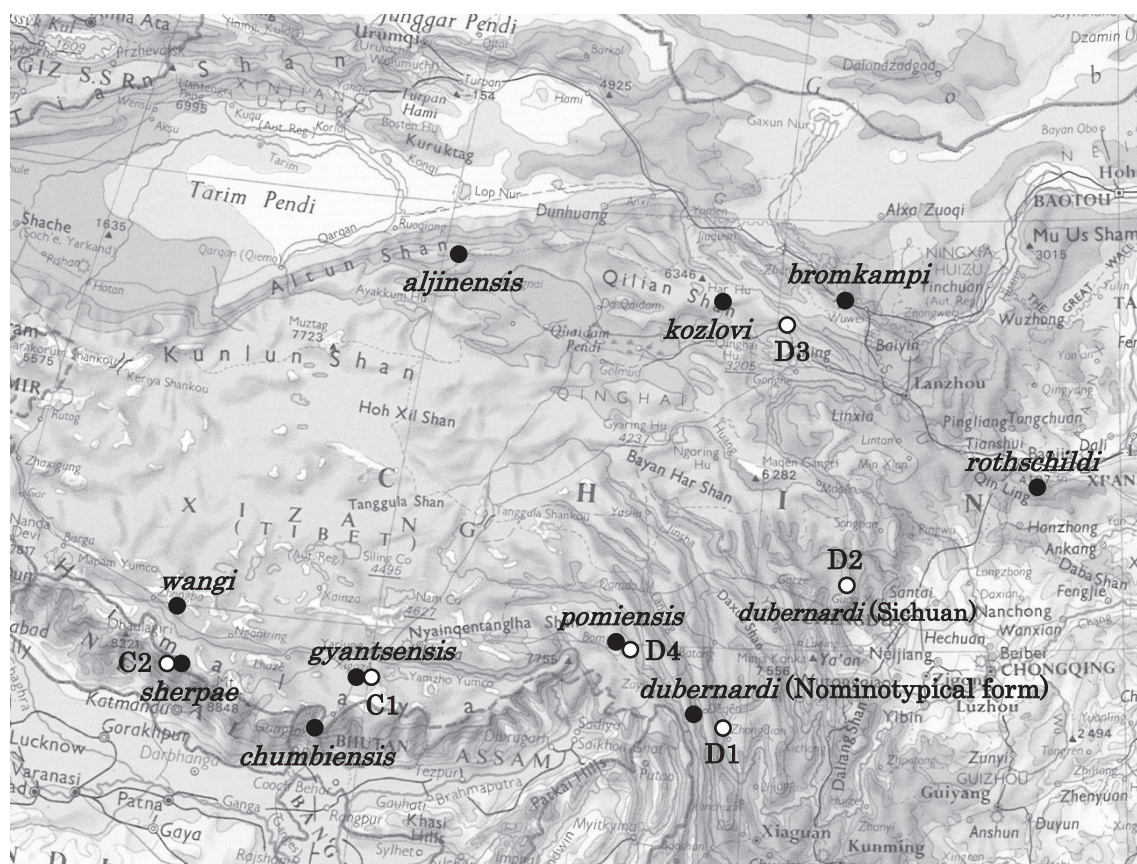


Fig. 18. Type localities and origins of specimens. Remarks ● Type locality ○ Origin of specimen.

others resemble *rothschildi* (Fig. 10) from Shaanxi.

③ *rothschildi* (Fig. 10) – Compared to the nominotypical subspecies (D1), post-discal band developed, and wing smaller. Black spots not present in spaces 5 and 3 on upper side hindwing. No recent record reported from Qinling (Tsing-ling) mountains, Shaanxi.

④ *pomienensis* (Figs 16 & 17) – Wing markings on upper side resemble the nominotypical subspecies (D1), but veins on hindwing underside thickly suffused with black scales. Wing expanse medium to large.

Latter group,

⑤ *kozlovi* (Figs 5 & 6) - Wing markings resemble the nominotypical subspecies of *dubernardi* on the upper side, but basal-discal area of hindwing underside thickly dusted with black scales. Post-discal band in male varies as shown in the co-type specimen in NHM, which resembles the female in wing markings, or specimen D3 from Qinghai Lake. Wing expanse small.

⑥ *bromkampii* (Fig. 11) - Type localities of *bromkampii* and *kozlovi* are close to each other. Post discal band further developed toward hindwing in paratype male specimen, as in female.

Hindwing underside similar to *kozlovi*, but larger in wing expanse.

⑦ *aljinensis* (Fig. 14) - Wing markings on upper side resembling the nominotypical subspecies of *dubernardi* but small in wing expanse. Hindwing underside resembles *kozlovi*: *aljinensis* was initially described as a subspecies of *kozlovi*.

It is apparent that the post-discal band in the male varies within the northern Sichuan population of *P. dubernardi* (Fig. 2) as well as in *kozlovi* (Figs 5 & 6), while the wing expanse and dusted degree of dusting of the basal-discal area on the underside hindwing seem to be constant within the same population.

#### Androconia:

Figure 19 shows the androconia of the specimens C1-C2 (subgroup-C) and D1-D4 (subgroup-D). In the general form of lamina and size of the scent cell, the *Pieris dubernardi*-group is similar to the *P. napi*-group (*P. napi*-related species) rather than the *P. rapae*-group or the *P. melete*-group as defined by Warren (1961), although the androconial necks of the *Pieris dubernardi*-group are longer and thinner than those of the *P. napi*-group. The numbers of sample specimen for each taxon may not be good enough to describe the distinct characteristics of each taxon, as this group has wide variations in length and width of

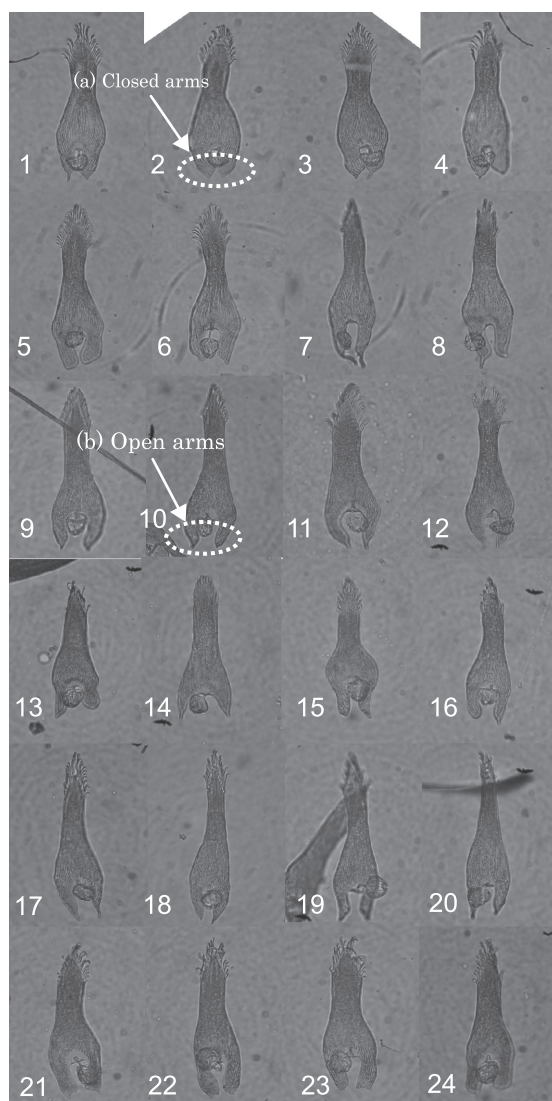


Fig. 19. Androconia of the *Pieris dubernardi*-group.

- 1-4: C1, *gyantsensis* (n=1),  
 5-8: C1, *sherpae* (n=2),  
 9-12: *P. dubernardi* (Yunnan), D1 (n=3),  
 13-16: *P. dubernardi* (Sichuan population), D2 (n=3),  
 17-20: *P. pomiensis*, D4 (n=1),  
 21-24: *P. kozlovi*, D3 (n=1).

lamina as well as shape of arms. Based on the limited information, the following trends may be indicated:

Difference between subgroup-C and subgroup-D:

Closed arms in subgroup-C similar to the *napi*-related species, while arms open in subgroup-D. Subgroup-C may be more closely related to the *napi*-related species than subgroup-D (Fig. 19a).

Difference between C1 and C2:

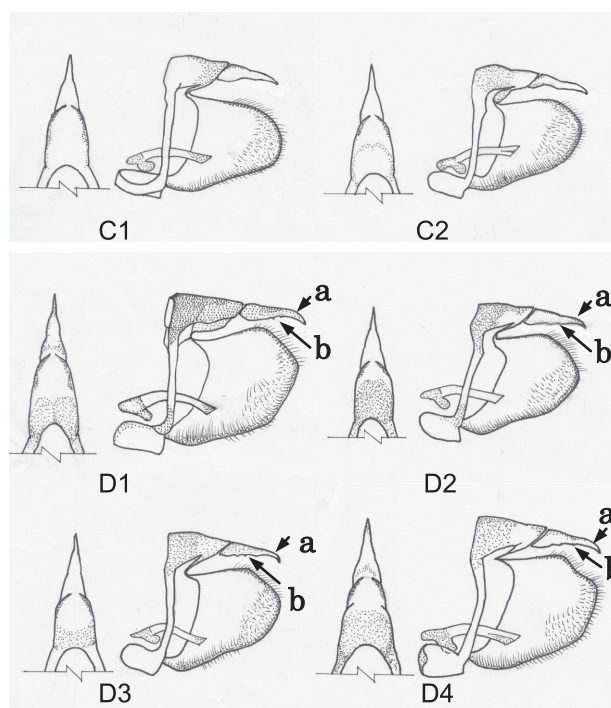


Fig. 20. Male genitalia of the *Pieris dubernardi*-group.

C1: *gyantsensis*, C2: *sherpae*, D1: *dubernardi* (N. W. Yunnan), D2: *dubernardi* (N. Sichuan) = *d. sichuensis* ssp. nov., D3: *kozlovi*, D4: *pomiensis*.

Arms of C1 (*gyantsensis*) are shorter than C2 (*sherpae*).

Difference between D1 and D2:

The Sichuan population has been included in the nominotypical subspecies of *P. dubernardi* from N. E. Yunnan since Leech's (1892-1894) classification. The laminae of D 1 (n=3), the nominotypical subspecies from N. W. Yunnan, are apparently longer than those of D 2 (n=3) from Northern Sichuan. This suggests that the Northern Sichuan population (D2) is a distinct population from the nominotypical subspecies, judging from the form of the androconia. D3 and D4 in comparison to D1: Although D3 (*kozlovi*) is slightly thicker, and D4 (*pomiensis*) is lightly thinner than D1 (*dubernardi*) in lamina, no important difference is found between them.

#### Male genitalia:

Figure 20 shows male genitalia of the specimens

C1-C2 (subgroup-C) and D1-D4 (subgroup-D). The shape of male genitalia in the *Pieris dubernardi*-group is similar to that in the *Pieris napi*-group in general, but the hairs inside the valva are thicker, and the hairy part seems to vary in every taxon. Furthermore, the form of sociuncus divides the *Pieris dubernardi*-group into two subgroups, C and D. In subgroup-D, the tip of the uncus is sharply bent (Fig. 20a), and the socius is serrated (Fig. 20b).



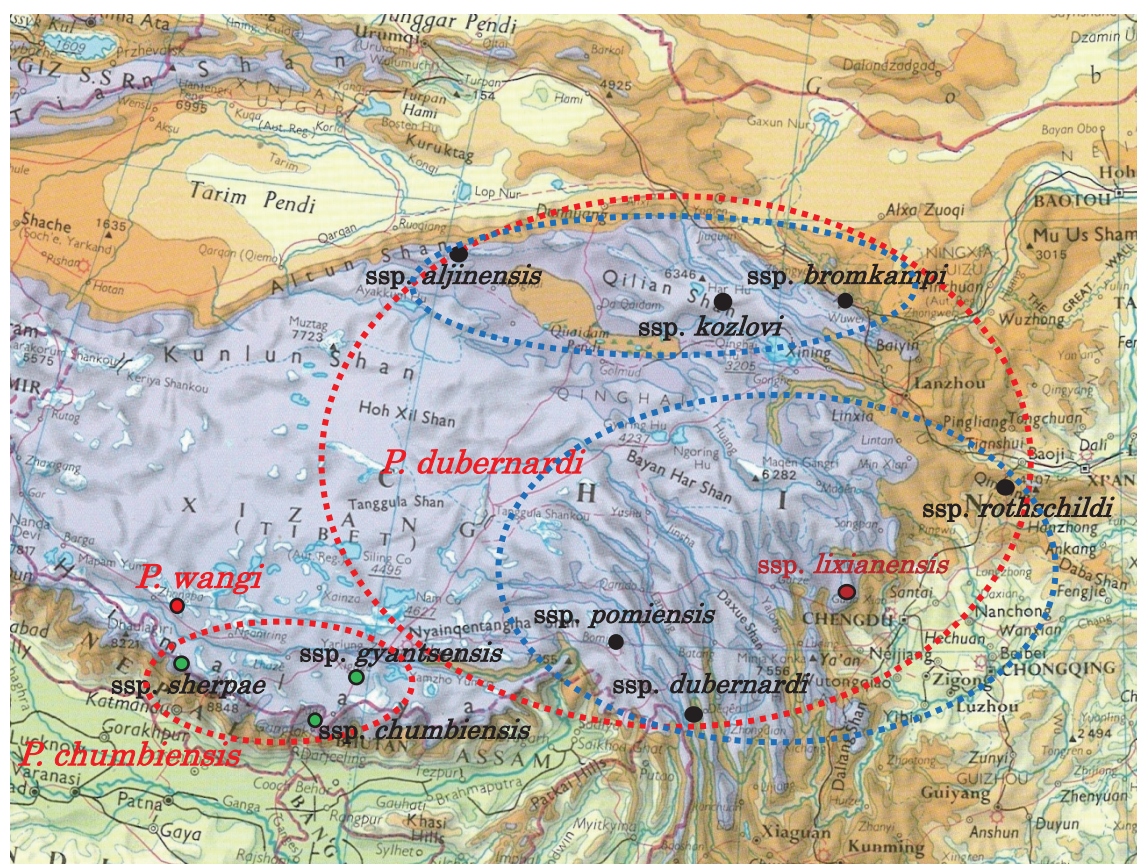


Fig. 21. Distribution of the *Pieris dubernardi*-group.

In subgroup-C, the tip of the uncus is not sharply bent, and the socius is a normal shape similar to the *Pieris napi*-group. In terms of the size of the genitalia, D1 (ssp. *dubernardi* from N. W. Yunnan) is larger than others. No other important difference is found within the same group.

#### Description of a new subspecies of *Pieris dubernardi* from Northern Sichuan

Based on the discussions above, *P. dubernardi* from Northern Sichuan (D2) is indicated as a different population from the nominotypical subspecies (Yunnan population), judging from the wing expanse, wing markings and androconia. We therefore describe the Northern Sichuan population as a new subspecies of *Pieris dubernardi* in this paper.

#### *Pieris dubernardi lixianensis* Tadokoro, Inomata & Wang ssp. nov. (Fig. 2, D2-1~D2-3)

Type specimens: Holotype: D2-2, Miyaluo (米亞羅) Li-Xian in northern Sichuan (alt. 3,700m), 1 VII 2013. Paratype: D2-1, same venue, same date as holotype. Paratype: D2-3, same venue, 23 - 24 VI 2014. (Holotype specimen will be deposited in the

Laboratory of Insect Ecology, South China Agricultural University, Guangzhou, China)

#### Diagnosis

Wing expanses: 48-50 mm in male. (LF= 25-27 mm) : Smaller than nominotypical subspecies.

Wing markings (in male): Upperside white with venation blackish. Veins become wide to create a series of triangular black spots along the margin. Costa suffused by black scales. Post-discal black band more developed than that of nominotypical subspecies, sometimes continuing from forewing to hindwing in upf. (upf : space 4-1b~1a, uph : 6-5~3, unf : space 3-1, unh : 6-3 slightly dusted). Black markings in uph spaces 3 and 5 prominent, while no black marking present in ssp. *rothschildi*. Underside forewings white with yellowish apex. Underside hindwing canary yellow ground color. Veins thickly suffused with black scales. Black streak in unh cell continues to the vein-5. Androconia: Lamina short (15-20% shorter than ssp. *dubernardi*).

Male genitalia: Resemble ssp. *dubernardi* but compact.

Female not found.

Etymology: The subspecific name '*lixianensis*' is derived from

Tabel 1. Summary of the *Pieris dubernardi* - group.

Taxa / Specimen				Typelocality	Morphological characteristics						
					Wing expanse and/or LF	unh wing basal-discal	Post-discal band - spaces		Androconia	Male genitalia	Fig.
							upf wing	unf wing			
Pieris dubernardi - group	dubernardi	dubernardi	D1	N, W, Yunnan [Tsékou]	Large 58-62mm LF=31-33mm	Plain	Constant ♂: (4)3-2 ♀: 10-1a	♂: 3-2(1b) ♀: 3-1b	Open arms	Large Uncs sharply bent Serrated socius	1, 2, [3]
		rothschildi	—	Shaanxi (extinct) [Tai-pai-chan]	Small / Medium [assumed by the figures in the plate]	[Plain]	[♂: (4)3-1b] [♀: 10-1a] [No black spot in space 5 & 3 uph]	[♀: 3-1b]	—	—	[10]
		pomiensis	D4	C. Tibet [Pomi]	Medium / Large 51-52mm LF=27.5mm [LF=30.5mm]	Plain Veins thickly suffused	♂: (4)3-2 (1b) ♀: 10~1a	♂: 3-1b ♀: 3-1b(1a)	Open arms	Medium Uncs sharply bent Serrated socius	[16], 17
		sichuanis ssp.nov	D2	N. Sichuan [Miyaluo]	Small 48-50mm LF=25-27mm	Plain	Variable ♂: (4)3-1b (1a)	♂: 3-1b(1a)	Open arms	Compact Uncs sharply bent Serrated socius	2
	kozlovi	kozlovi	D3	Qinghai [Nan-shan]	Small [43-48mm] 50mm 27-28mm	Dusted	Variable ♂: (4)3-1b (1a) ♀: 10-1a	♂: 3-1b ♀: 3-1b	Half Closed arms	Compact Uncs sharply bent Serrated socius	[5], 6
		bromkampii	—	Gansu [Minschan mont.] =Min-shan	Medium [54-57mm]	[Dusted]	[♂: 4-1a]	[♂: 3-1b(1a)]	—	—	[11]
		aljinensis	—	Xinjiang [Aljin]	Small / Medium [LF=24-28mm]	[Dusted]	[♂: (4)3-2(1b)]		—	—	[14]
	chumbiensis	chumbiensis	—	Sikkim, India [Chumbi]	Medium [55mm] [LF=26mm]	[Half dusted]	[♂: 3]	[♂: 3]	—	—	[4]
		gyantsensis	C1	S.Tibet [Gyantse]	Small / Medium 45-52mm LF=24.5-26	Plain	Constant ♂: 3+2=faint ♀: 3-1a	♂: 3+2+1=faint ♀: 3-1a	Closed arms	Compact	8, 9
		sherpae	C2	[C, Nepal]	Small / Medium 45-53mm LF=25-27 [LF=24.4-26.8mm]	Dusted	Constant ♂: 3 ♀: 3-1a	♂: 3 ♀: 3-1b(1a)	Closed arms	Compact	[12], 13
	wangi	wangi	—	W. Tibet [Duoxiongla]	Large [58mm] [LF=31.5-33mm]	[Plain] (veins not suffused)	[♂: 10-1b] [♀: 10-1a]	[♀: 3-1b]	—	—	[15]

its habitat of Li-xian district in Sichuan, China.

Remarks: Further examination will be required to ascertain whether the population from the southern part of Sichuan belongs in ssp. *dubernardi* or ssp. *lixianensis*. In this paper, we tentatively treat the southern Sichuan population as the nominotypical subspecies (ssp. *dubernardi*) to follow the historical classification.

## Conclusion

Based on the results and discussions above, we propose four distinct species with some intraspecific taxa as follows:

### 1. *Pieris dubernardi* Oberthür, 1884

*P. d. dubernardi* Oberthür, 1884 - from N.W. Yunnan & S.

Sichuan, China (Tsékou = Yanmen)

*P. d. rothschildi* Verity, 1911 - from Qinling-shan, Shaanxi, China (Taipai-shan)

*P. d. pomiensis* Yoshino, 1998 - from C. Tibet, China (Pomi)

*P. d. lixianensis* Tadokoro, Inomata & Wang, ssp. nov. - from N. Sichuan, China (Miyaluo)

### 2. *Pieris kozlovi* (Alphéraky, 1897)

*P. k. kozlovi* (Alphéraky, 1897) - from Nan-shan, Qinghai, China (Humbolt -chain)

*P. k. bromkampii* (Bang-Haas, 1938) - from Gansu, China (Min-shan)



*P. k. aljinensis* (Huang & Murayama, 1992) - from Xinjiang, China (Aljin-shan)

### 3. *Pieris chumbiensis* (de Nicéville, 1897)

*P. c. chumbiensis* (de Nicéville, 1897) - from Sikkim, India (Chumbi valley)

*P. c. gyantsensis* Verity, 1911 - from E. Tibet, China (Gyantse near Lhasa)

*P. c. sherpae* (Epstein, 1979) - from Central Nepal

### 4. *Pieris wangi* (Huang, 1998) - from W. Tibet, China (Duoxiongla, Metok)

Table 1 shows the summary of the morphological characteristics for the *Pieris dubernardi* group.

Distribution map is shown in the Figure 21.

## Acknowledgments

Special thanks to Dr Blanca Huertas, the senior curator of NHM in London, for providing us with photographs of the type specimens, Ms Lorraine Portch of NHM, Library and Archives, for providing us with the copies of relevant original descriptions. We also express our gratitude to Mr. Yuichi Koide for providing us with his precious specimens and Dr Valerio Sbordoni, Mr Yasunori Kishida, Dr Masaya Yago, Mr Shigeru Inaoka, Mr Noriaki Asou and all members of Takao Seminar for providing us with a lot of information and advice.

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## 摘要

*Pieris dubernardi* グループの分類学的再検討, ならびに中国四川省北部からの *Pieris dubernardi* の 1 新亜種の記載(鱗翅目, シロチョウ科)(田所輝夫・猪又敏男・王 敏)

*Pieris dubernardi* (ミヤマシジグロシロチョウ) グループは、ヒマラヤ・チベット山系の標高 3,000-5,000 m の高山帯に分布する (Fig. 18) 年 1 化性の *Pieris* 属で、これまでに *dubernardi* Oberthür, 1884 (Figs 1, 3), *chumbiensis* (de Nicéville, 1897) (Fig. 4), *kozlovi* (Alphéraky, 1897) (Figs 5, 6), *gyantsensis* Verity, 1911 (Figs 8, 9), *rothschildi* Verity, 1911 (Fig. 10), *bromkampii* (Bang-Haas, 1938) (Fig. 11), *shelpae* (Epstein, 1979) (Figs 12, 13), *aljinensis* (Huang & Murayama, 1992) (Fig. 14), *wangi* (Huang, 1998) (Fig. 15) 及び *pomiensis* Yoshino, 1998 (Figs 16, 17) の 10 のタクサが記載されている。これらの蝶はいずれも生息地がアクセスの難しい山岳地に限られ、標本数も少なく生態も不詳な上、近年の新属の記載や統廃合などの理由から、この 130 年間に *Pieris*, *Aporia*, *Parapieris*, *Synchloe*, *Pontia* あるいは *Sinopieris* 属に分類されてきたが、最近 Tadokoro and Wang (2014) により分子系統的に広義の *Pieris* 属に含まれることが確認された。しかし種レベルの分類に関しては依然未整理の状態にあり、研究者によって分類はさまざまである。著者たちは最近いくつかの標本を入手したことから、本グループに属する蝶の種及び亜種レベルの分類をあらためて見直した。タイプ標本や原記載の写真や細密画、及び最近入手したいくつかの蝶の標本をもとに、翅長・翅形・斑紋・発香鱗及び交尾器等を比較検討した結果を以下に示す。

翅長・翅形・斑紋

成虫の翅形及び斑紋により大きく *dubernardi*, *chumbiensis*, *wangi* の 3 サブグループに分けられる。 *P. dubernardi* サブグ

ループには *dubernardi* の他, *kozlovi*, *rothschildi*, *bromkampii*, *aljinensis* 及び *pomiensis* が含まれ, *P. chumbiensis* サブグループには *chumbiensis* に加えて *gyantsensis* 及び *sherpae* が含まれる。この2つのサブグループの区別点としては, *P. chumbiensis* サブグループでは♂の場合表面前縁部の第10~12室が黒鱗に覆われない点, さらに♀ではそれが5室まで続く点(Figs 4, 9 & 13 (-a)). さらに♂では前翅表面第3室の黒斑が独立して上下の第2室や第4室に繋がらない点が挙げられる(Figs 4, 9 & 13 (-b)). *P. wangi* サブグループは亜外縁部の黒帯が表面と裏面とで大きく異なる点において特異な形質を有している。なお, *P. dubernardi* サブグループに含まれる6のタクサでは, 表面の斑紋が似ているものの, 後翅裏面の黒化程度と生息地によってさらに *dubernardi* 亜種群 (*dubernardi*, *rothschildi*, *pomiensis* を含む) と *kozlovi* 亜種群 (*kozlovi*, *bromkampii*, *aljinensis* を含む) の2亜種群に分けられる。この内, *ssp. rothschildi* は近年の採集記録がまったくない。また *dubernardi* に関しては, 大型で斑紋に変異がほとんどない雲南省北西部産の名義タイプ亜種に比較して四川省北部産の個体群は極めて小型で表面亜外縁部の黒帯が発達しており, 別亜種であることが示唆される。タクソン毎の詳細な比較を Table. 1 に示した。

#### 発香鱗 (Fig. 19)

発香鱗の形状(ラミナの形状や香囊サイズ)から判断すると, *Pieris dubernardi* グループは *P. napi* グループに近縁であることがうかがえるが, ラミナ頸部が *P. napi* グループのものに比較して細長いことから特殊なグループであることが示唆される。グループ内の変異に関しては標本数が充分でないことから断定はできないが, 限られた情報から敢えて差別化するならば, *P. dubernardi* サブグループは腕部が先端で開く傾向があり, *P. chumbiensis* サブグループは腕部が先端で閉じる傾向があるように思われる。発香鱗の形状(特に腕部の形状)からは *P. chumbiensis* サブグループは *P. dubernardi* サブグループに比較して *P. napi* グループにより近縁ではないかと推察される。

#### ♂交尾器 (Fig. 20)

♂交尾器もまた *P. napi* グループに似ているが, バルバ内側の刺毛が太く濃い。また繊毛部の範囲が各タクサで特徴があるように思えるが, 検体数が少なく断言はできない。なお, ソキウスの形状で *P. dubernardi* グループを二つのサブグループ(*P. dubernardi* サブグループと *P. chumbiensis* サブグループ)に分けることができる。*P. dubernardi* サブグループではウンス先端部が強く折れ曲がり, ソキウスは鋸状だが, *P. chumbiensis* サブグループではウンスの先

端部の折れ曲がり方もソキウスの形状も *P. napi* グループに極めて近似している。交尾器の大きさでは D1 (雲南省北西部産 *dubernardi* 名義タイプ亜種) が他に比較して大型である。

#### 新亜種記載

上記の観察結果より四川省北部産の個体群は雲南省北西部産の名義タイプ亜種とは異なる個体群であることが示唆されるため, ここに新亜種として記載する。

*Pieris dubernardi lixianensis* Tadokoro, Inomata & Wang **ssp. nov.** (Fig. 2, D2-1~D2-3)

タイプ標本: ホロタイプ♂: Fig. 2, D2-2, パラタイプ♂: Fig. 2, D2-1, D2-3 すべて四川省北部理県米亜羅 (標高 3,700 m)。ホロタイプ標本は中国広州市の華南農業大学昆虫生態学教室に保管予定。

開翅長: 48 - 50 mm ♂。

斑紋 (♂): 裏面は名義タイプ亜種に近似するが表面の亜外縁部の黒帯が発達し, 名義タイプ亜種に近いものから♀の斑紋に近いものまで変異が大きい。秦嶺山脈を基産地とする *ssp. rothschildi* (Fig. 10) とは, 後翅表面第5室及び第3室の黒斑の有無により区別できる。

発香鱗: ラミナが短い。(名義タイプ亜種に比較し, 15-20% 程度短い)

♂交尾器: 名義タイプ亜種に近似するが小型。

♀標本は未確認。

亜種名: *lixianensis* の語源は生息地である中国四川省理県 (Li-xian)。

備考: 四川省南部産の個体群は *ssp. dubernardi* もしくは *ssp. lixianensis* のいずれかに属すると考えられるがさらなる検証が必要。ただし, 当該報文においては歴史的な分類に従い暫定的に *ssp. dubernardi* に分類する。

#### 結論

上記の検討結果及びこれまでの歴史的な分類を考慮し, *Pieris dubernardi* グループを4種に分類した(本文参照)。これらの蝶の形態的特徴は Table. 1 に, また分布図は Fig. 21 に示した。

(Received March 4, 2016. Accepted August 19, 2016)